

Generation II Coastal Risk Model

Verification and Testing Report

**U.S. Army Corps of Engineers
Institute for Water Resources**

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Section 1

Introduction

The software quality assurance (SQA) process employed during Generation II Coastal Risk Model (G2CRM) development was composed of configuration management of source code, internal code evaluation, design evaluation, prototype evaluation, and the software testing process. The software testing process implemented for G2CRM included unit testing, integration testing, user acceptance testing as well as field testing on a Corps study. This document is intended to outline the SQA procedures and processes used during development of G2CRM.

Section 2

Model Development Review and Evaluation

2.1 Design Evaluation

Evaluation of G2CRM design documents and subsequent technical memorandums was performed by appropriate individuals within the U.S. Army Corps of Engineers (Corps) planning community. Feedback from this evaluation was incorporated into the development process to guarantee compliance with functional requirements, and to ensure that all design elements flow from the requirements properly.

2.2 Prototype Evaluation

An agile development process was used for G2CRM to incorporate the principle of rapid prototype delivery, review, and evaluation into the software development process. Early prototypes of G2CRM were reviewed by development team members at the IWR, ERDC and Corps districts. Feedback from prototype reviews served to further clarify design requirements and resolve defects in the product which may stem from inadequate requirements or design specifications early in the development process when such deficiencies are easily corrected.

2.3 Internal Reviews

Regular internal code reviews provided a foundation for software quality assessment. Code reviews occur periodically during the development process, and cover all aspects of the application functionality. A code review is a critical evaluation of code by other developers, with the emphasis on providing positive and constructive feedback on corrections or

improvements to the code, for the developer. Such reviews, in the form of internal source code walkthrough meetings and periodic code inspections, were implemented as part of the G2CRM quality management process.

Section 3

Software Testing

The software test plan of G2CRM was performed at the unit level and integration testing level, along with user testing and deliverable acceptance testing. An internal software defect tracking application known as FogBugz was used to report, manage, and resolve software defects noted during the testing process.

3.1 Unit Testing

During the development process, developers tested each unit of each release thoroughly before delivery. Unit testing occurred throughout the development process, as an integral part of development, with a period of dedicated unit testing occurring at the end of each prototyping cycle.

3.2 Integration Testing

Following unit testing, the team performed integration testing of the system components. Quality assurance staff tested the entire G2CRM application to ensure that all functional elements, such as the simulation processor, data importer, and user interface performed in conjunction with one another in accordance with specified design details and functional requirements.

3.3 Acceptance Testing

Testing by eventual users began following completion of the integration testing for each prototype. During this phase, any problem areas were addressed and a new version of G2CRM was provided if necessary. Prior to releasing a new or revised version of the model, an economist, engineer or similarly qualified staff tested the functionality and usability of the tool. These real world applications further identified behavioral abnormalities and ease of use issues that were rectified.

3.4 Model Fielding

Field testing involves testing a product in the actual context in which it will be used, i.e. in Corps districts by Corps economists or similar qualified staff. Through field testing, development teams are able to identify and correct problems with model processing logic, usability enhancements, and software defects. As of the time of this writing, the G2CRM has been field tested on a study for the Baltimore District and the testing that was performed through that application is included as a separate file, Level 2 Review of G2CRM for Single Use.

3.5 Issue Management

The issue management process consists of several general steps: issue identification, evaluation and assignment, resolution, reassignment to tester, testing, and reopening or closure of issue depending on testing outcome. The G2CRM development team used the FogBugz issue tracking system to formally track and resolve issues during the development lifecycle. Implementation of proper issue tracking protocols helped ensure the quality of the G2CRM product and helped establish a process for communicating software issues in a defensible, traceable, and documented manner. A record of all bugs or system enhancements identified and addressed during the development process is stored within this tracking system.

3.6 Configuration Management

For configuration management purposes, Kiln was used to manage the quality of the source code elements of the project. Maintaining the integrity of the source code, managing code changes, and controlling version and release levels were all implemented through the Kiln tool. The historical record of development generated through the correct use of the configuration management toolset was a valuable asset in evaluating past development activities and planning future actions.